

Development of e-stick for blind persons using IoT

Gopisetty Ramesh^{1*} Narendra B. Mustare² K. Uday³ C. Pramod Kumar⁴

^{1,3,4} Senior Assistant Professor, Department of Electronics and Instrumentation Engineering,
CVR College of Engineering, Hyderabad, Telangana, India-501510

² Professor, Department of Electronics and Instrumentation Engineering, CVR College of Engineering,
Hyderabad, Telangana, India-501510

*Corresponding Author

Abstract: The blind and impaired people are suffering a lot because there are so many struggles for blind peoples to reach their destination and also there are dangerous risks that blind persons must face. To avoid uncomfortable walking experience, we have designed a smart electronic walking stick for blind people. Our paper proposes a low-cost walking stick based on latest technology and a new implementation are made for efficient interface for blind people. Basically, the ultrasonic sensor is implemented in the walking stick for detecting the obstacles in front of the blind/impaired persons. If there are any obstacles, it will alert the blind person to avoid that obstacle and the alert in the form of voice announcement. Daily in different aspects in order to provide flexible and safe movement for the people. In this technology driven world, where people strive to live independently, this paper propose a low-cost 3D ultrasonic stick for blind people to gain personal independence, so that they can move from one place to another easily and safely. A portable stick is design and developed that detects the obstacles in the path of the blind using ultrasonic sensors. The voice announcement is activated when any obstacle is detected. In addition, the stick is equipped with an SMS message system. SMS system is used by the blind to send SMS message to the saved numbers in the microcontroller in case of emergency. The programming of voice announcement has been successfully done for this system. Computer simulation is done to essence the performance of the system using Proteous software.

Keywords: UV sensor, node-MCU, Bluetooth, Arduino

I. INTRODUCTION

The visually impaired are at a considerable disadvantage because they often lack the information for avoiding obstacles and hazards in their path. They have very little information on self- velocity, objects, direction which is essential for travel.

The system designed will detect an object or obstacle using ultrasonic sensors and gives audio instructions for guidance. An obstacle as close to minimum distance can be detected by this module. A resolution of obstacle distance has been designed and achieved. It is very important to maintain efficient information while travelling to the blind people. This system has been aimed at design and development of a smart and intelligent blind stick which helps in navigation for the visually impaired people. The navigator system designed will detect an object or obstacle using ultrasonic sensors and gives audio instructions for guidance. The signals from the ultrasonic sound are processed by a microcontroller in order to identify sudden changes in the ground gradient and/or an obstacle in front. The algorithm developed gives a suitable audio instruction depending on the duration of ultrasound travel. We developed this system to detect the obstacle while travelling and giving voice notification to visually impaired people.

Artificial vision is the most important part of human physiology as 83% of information human being gets from the environment is via sight. The oldest and traditional mobility aids for persons with visual impairments are the walking stick. The drawbacks of these aids are range of motion and very little information conveyed. With the rapid advances of modern technology, both in hardware and software front brought potential to provide intelligent navigation capabilities. To identify the position and orientation and location of the blind person are rely on Global Positioning System (GPS) technology. The system is also equipped with SMS system. Whenever the persons feel danger then the person should press the panic button then the SMS system is used to send the messages and location of the person by using GPS to the numbers which are saved in the microcontroller.

The intelligent devices have taken us to a convenient and fashionable era. The blind people even do not have ability to walk independently. There is no doubt that they are eager for convenience and freedom based on this, this project propose an intelligent system that assists the blind in walking. The system consists of two ultrasonic sensors which are used to detect the obstacles or dig information in front of the blind person. Whenever there is an obstacle or dig then this system alerts the blind person in the form of voice message. The system has different sounds for obstacle and dig information and alert in the form of respected voice messages.

II. LITREATURE SURVEY

The main aim of this system is to permit the blind persons to explore automatically in the outside environment. Ordinary route navigational systems in the outdoor environment are expensive and its manufacturing is time consuming. Blind people are at expensive drawbacks as they regularly do not have the data which is required, while passing obstacles and dangers. They generally have little information about data such as land marks, heading and self-velocity information that is crucial for them to explore them through new environment.

This system presents a concept to provide a smart electronic aid for blind people. The system is intended to provide overall measures artificial vision and object detection, real time assistance via global positioning system (GPS). The aim of the overall system is to provide a low cost and efficient navigation aid for blind which gives a sense of artificial vision by providing information about the environmental scenario of objects around them.

[1] Jismi johnson et al., (2013) presents the smart walking stick helps blind people in moving and allowing them to perform their work easily and comfortably. The blind person cannot recognize what is the size of that object and how far is he from the object. So, it is difficult for blind person to move here and there. The smart walking stick supports object recognition and output comes mainly in the form of voice output. In Smart Walking Stick, we detect the object with the help of a camera. The stick measures the distance between objects and smart walking stick by ultrasonic sensor. When the objects or obstacles come in range of the ultrasonic sensor, the speaker tells name of obstacle in front of the stick. Images will be captured using a camera and the camera is connected to the Raspberry Pi. If any obstacle comes in front of blind person, he can know about the obstacle by hearing the sound generated by the head phone. The smart walking stick is very useful for the visually impaired persons for their safety and freedom from the other persons at all the time. The developed system gives good results in detecting obstacles in front of the user.

[2] K. Ramarethinam et al., presents the project is to provide the navigation information via

audible messages and haptic feedback to the visually impaired people helping them to improve their mobility independently. The system with portable self-contained feature that allows the blind people to travel through familiar and unfamiliar environment. The system consists of hardware and software. In this system the Braille capacitive touch screen enables a user-friendly communication with the systems. All the operations can be made with this touchscreen. The major components are the GPS receiver and path detector used for receiving the current position and finding the current position and finding the shortest path to the destination. The navigation process of the system will start once the user gives the destination as voice command. The system is provided with an emergency button which will trigger an SMS that will send the present location of the user (GPS coordinates) to a remote phone number asking for help, in case of emergency. In addition, the device provides user information needed, in audio format, including time, calendar, object colour, alarm, obstacle detection, navigation direction, ambient light and temperature conditions. This project will help the blind people in improving their communication ability and not to depend on anyone during walking in even unknown areas.

[3] Kher Chaitrali S et al., (2013), presents the visually impaired have to face many challenges in their daily life. The problem gets worse when they travel to an unfamiliar location. Only few of the navigation systems available for visually impaired people can provide dynamic navigation through speech output. In this paper, we propose a navigation device for the visually impaired which is focused on providing voice output for obstacle prevention and navigation using infrared sensors, RFID technology, and android devices. The device has proximity infrared sensors. RFID tags are installed into public building and also integrated into blind person's walking stick. This device is connected to an android phone through Bluetooth. An android application is designed which gives voice navigation based on RFID tags read and also updates person's location information on the server. One more application is designed for family members to access the blind person's location through the server whenever needed. It aims to solve the problems faced by the blind people in their daily life. This system also takes measures to ensure their safety.

[4] Jini.S et al., paper presents the architecture and implementation of a system that will help the visually impaired people to navigate using GPS technology. The system provides artificial guidance to the visually impaired through known paths, that is the path for navigation has to be already stored in the microcontroller. The current latitude and longitude values of the user are obtained using GPS. These values are continuously compared with the already stored value in the microcontroller. Thus, helps the blind in navigation. The goal is to create a portable, simple and less costly system that will allow user to travel through familiar and unfamiliar environments without the aid of guides. Also, it provides voice recognition to detect obstacles. The obstacles are detected using ultrasonic sensors. The commands and messages are played back to the blind via APR9600 voice playback IC. The keypad used in system allows the user to select the desired locations to which he/she wishes to go. Keypad consists of 12 keys where each key represents a location. Blind selects the key using Braille language. The paper focuses on the development and evaluation of a navigation system that makes use of GPS, voice and ultrasonic sensor for obstacle detection.

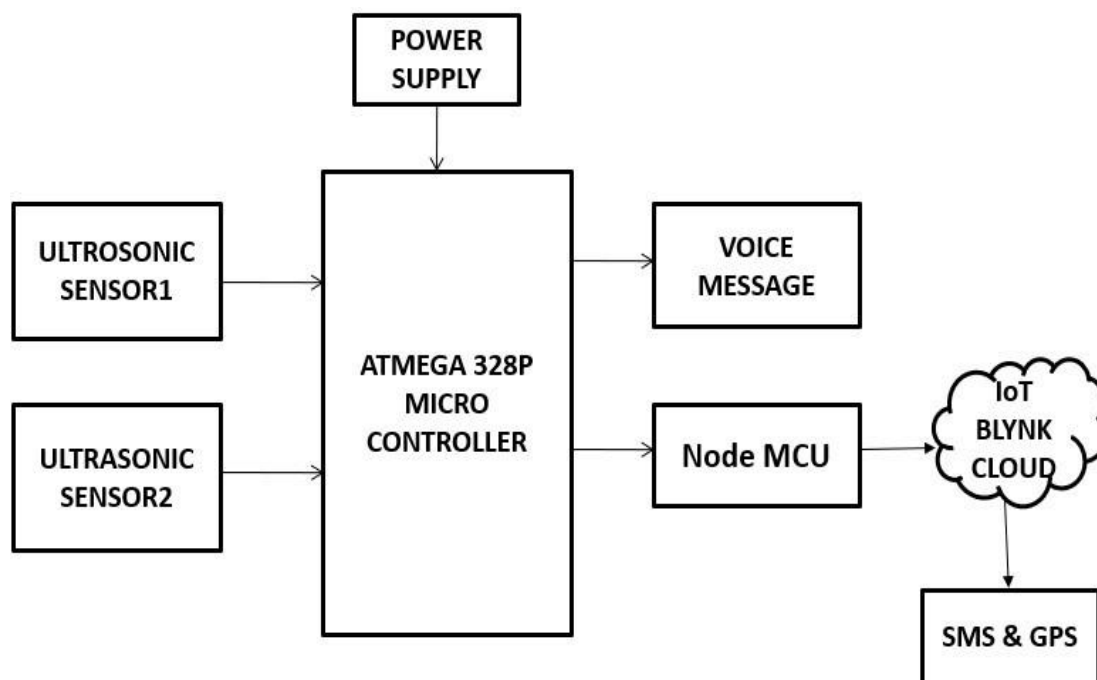
BLOCK DIAGRAM

Figure 1. shows the block diagram of the system

Figure 1 shows the block diagram of the system. The block diagram mainly consists of ATMEGA328P, Node-MCU, ultrasonic sensor, IoT blynk cloud.

A. ATMEGA328P

The Atmel ATmega328P is a 32K 8-bit microcontroller based on the AVR architecture. Many instructions are executed in a single clock cycle providing a throughput of almost 20 MIPS at 20MHz. The ATMEGA328-PU comes in a PDIP 28 pin package and is suitable for use on our 28 pin AVR Development Board.

B. Node-MCU(ESP8266-12E)

ESP-12E Wi-Fi module is developed by Ai-thinker Team. core processor ESP8266 in smaller sizes of the module encapsulates Tensilica L106 integrates industry-leading ultra-low power 32-bit MCU micro, with the 16-bit short mode, Clock speed support 80 MHz, 160 MHz, supports the RTOS, integrated Wi-Fi MAC/BB/RF/PA/LNA, on-board antenna. The module supports standard IEEE802.11 b/g/n agreement, complete TCP/IP protocol stack. Users can use the add modules to an existing device networking, or building a separate network controller. ESP8266 is high integration wireless SOCs, designed for space and power constrained mobile platform designers. It provides unsurpassed ability to embed Wi-Fi capabilities within other systems, or to function as a standalone application, with the lowest cost, and minimal space requirement.

C. Ultrasonic Sensor

The ultrasonic sensor is a transducer which converts electrical energy into sound waves and vice versa. These sound waves fall above the normal range of human hearing and hence it is known as ultrasonic waves. These types of waves are above the frequency of about 18000 Hz.

Ultrasonic sensors are used to detect the presence of targets and to measure the distance to targets in many robotized processing plants and process plants. Sensors with an ON or OFF digital

output are available for detecting the presence of objects and sensors with an analog output which changes relatively to the sensor to target separation distance are commercially available. Ultrasonic obstacle sensor consists of a set of ultrasonic receiver and transmitter which operate at the same frequency. The point when the something moves in the zone secured the circuit's fine offset is aggravated and the buzzer/alarm is triggered.



Figure 2. Ultrasonic Sensor

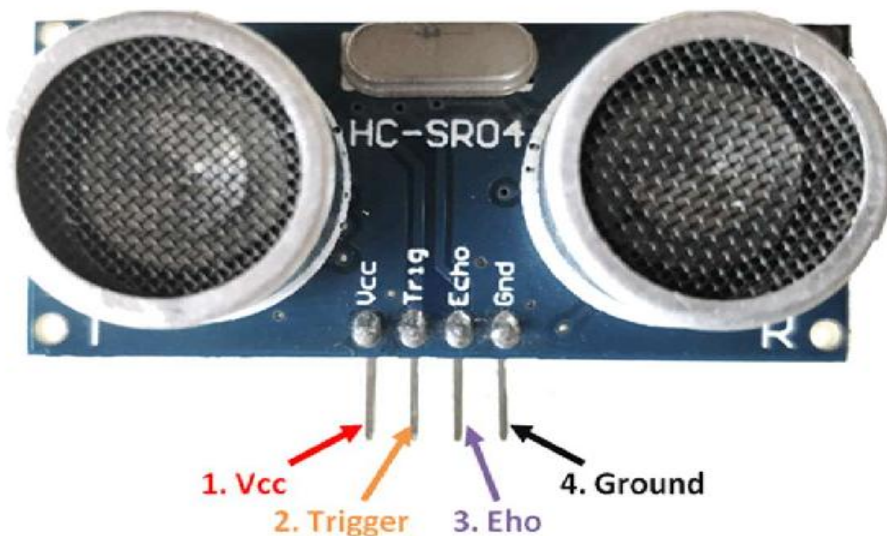


Figure 3. Pin diagram of Ultrasonic Sensor

D. BLYNK CLOUD

Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other cool things.

Blynk is a platform with iOS and Android apps to control Arduino, Raspberry Pi and the likes over the Internet. It's a digital dashboard where you can build a graphic interface for your project by simply dragging and dropping widgets. It's really simple to set everything up and you'll start tinkering in less than 5 mins. Blynk is not tied to some specific board or shield. Instead, it's supporting hardware of your choice. Whether your Arduino or Raspberry Pi is linked to the Internet over Wi-Fi, Ethernet or this new ESP8266 chip, Blynk will get you online and ready for the Internet of Your Things.

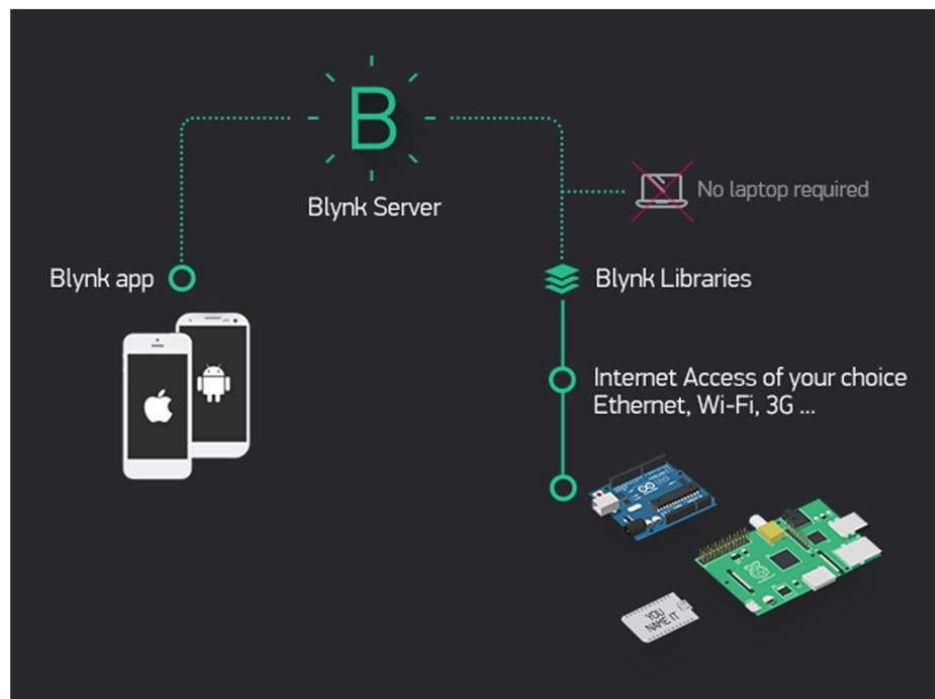


Figure 4. Blynk app major components

III. IMPLEMENTATION

Blind stick is an innovative stick designed for visually disabled people for improved navigation. We here propose an advanced blind stick that allows visually challenged people to navigate with ease using advanced technology. The blind stick is integrated with ultrasonic sensors. Our proposed project uses the ultrasonic sensors to detect the obstacles ahead using ultrasonic waves. On sensing obstacles or dig information, the sensor passes the data to the microcontroller. The microcontroller then processes this data and calculates if the obstacle is close the microcontroller sends a signal to sound of a speaker. It also detects and sounds a different sound if it detects the dig and alerts the blind.

The system has one more advanced feature integrated to help the blind by using Node-MCU. Node-MCU has a built in wifi module. That means it can easily connect it to wifi with few lines of codes. The stick is equipped with SMS system. Whenever the blind person is in danger then the person has to press the panic button, so that the SMS system is used by the blind to send SMS to the saved numbers in the microcontroller by using the blynk app. By using this blynk app the data sends to the cloud to track the location of the person by using GPS and sends to the numbers which are saved in microcontroller in case of emergency.

IV. RESULT

The output of the system is to send the voice message whenever the person is close to the obstacles and dig by calculating the distance measurement and alert in the form of voice message through the speaker. The system is also used to track the global positioning of the system whenever the person is in emergency. By pressing the panic button of the stick, it will alert in the form of sending messages and location to the saved numbers in the microcontroller.



Figure 5. Hardware setup

V. CONCLUSION

The smart stick acts as a basic platform for the coming generation of more aiding devices to help the visually impaired people to be more safe. It is effective and afford. It leads to good results in detecting the obstacles lying ahead of the user in a range of four meters, detecting obstacles. This system offers a low cost, reliable, portable, low power consumption, and robust solution for navigation with obvious short response time.

REFERENCES

- [1]. M. S. Nowak and J. Smigielski, "The Prevalence and Causes of Visual Impairment and Blindness among Older Adults in the City of Lodz, Poland." *Medicine*, vol 94, number 5, pp. e505, February 2015 doi:10.1097/MD.0000000000000505
- [2] G. Gayathri, M. Vishnu Priya, R. Nandhini and M. Banupriya "Smart Walking Stick for Visually Impaired." *International Journal of Engineering and Computer Science*, vol. 3, number 3, pp. 4057- 4061, 2014.
- [3] R. Radhika, P.G. Pai, S. Rakshitha and R. Srinath "Implementation of Smart Stick for Obstacle Detection and Navigation." *International Journal of Latest Research in Engineering and Technology*, vol. 2, number 5, pp. 45-50, 2016.
- [4] M.H. Mahmud, R. Saha and S. Islam "Smart Walking Stick – An Electronic Approach to Assist Visually Disabled Persons." *International Journal of Scientific and Engineering Research*, vol. 4, number 10, pp. 111-114, 2013.
- [5] A. Jose, G. George, M.R. Nair, M. J. Shilpa and M. B. Mathai "Voice Enabled Smart Walking

Stick for Visually Impaired.” International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, vol. 5, pp. 80-85, 2016.

[6] R. Sheth, S. Rajandekar, S. Laddha and R. Chaudhari “Smart White Cane – An Elegant and Economic Walking Aid.” American Journal of Engineering Research. Vol. 3, number 10, pp. 84-89, 2014.

[7] C.S. Kher, Y.A. Dabhade, S.K. Kadam., S.D. Dhamdhare and A.V. Deshpande “An Intelligent Walking Stick for the Blind.” International Journal of Engineering Research and General Science, vol. 3, number 1, pp. 1057-1062, 2015.